Application of Advanced and Renewable Energy Technologies

Well-Proven Technologies Pay off in the Right Application

AdvanTek

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Renewable Technologies

Solar Parking Lot Lights
Solar Water Heating
Windpower
Ocean Water Cooling

Solar Parking Lot Lights

Typical Example

- **US Army Fort Hood, TX**
- **22 Lights @ $3,500 each**
- **Installed Cost: $88,400**
- **Annual Savings: $17,000**
- **Simple Payback: 5.2 years**

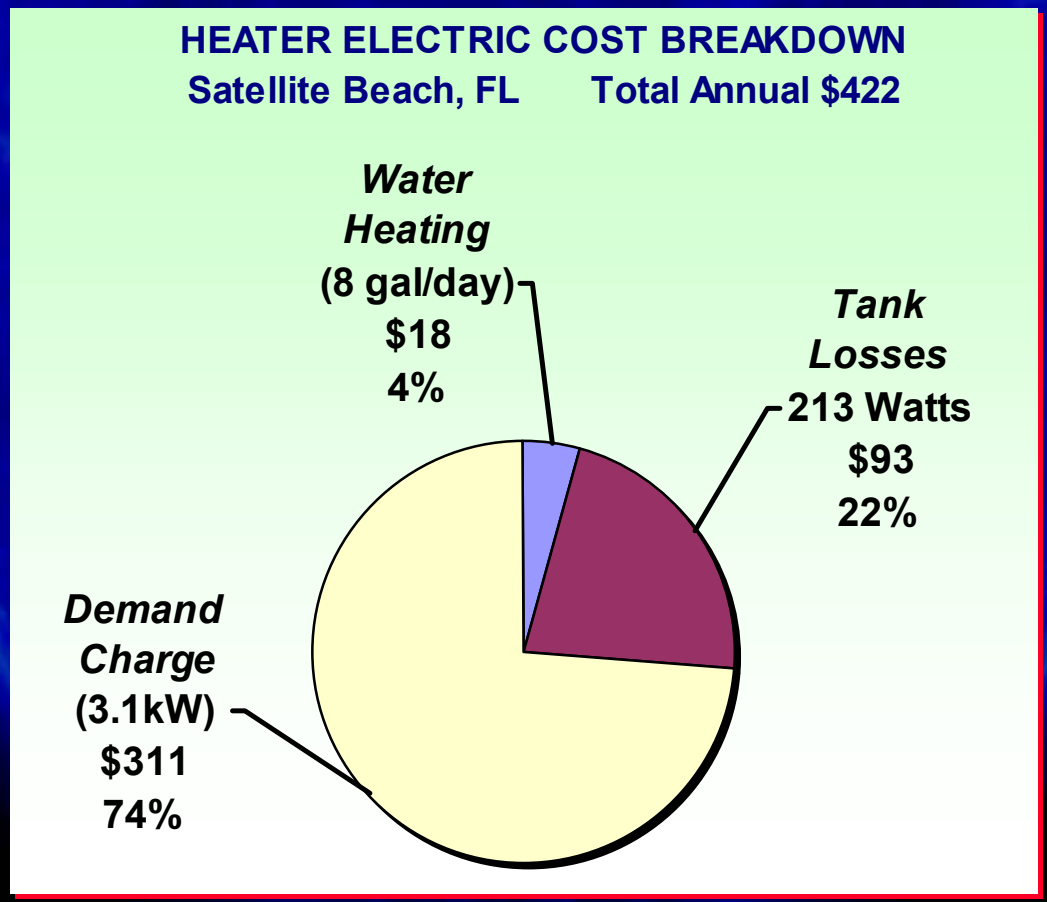
Solar Water Heating

- Annual savings from a properly applied system will be 70% to 90%– about $200 to $1,500 per year depending on existing heater and gallons per day.
- Total installed cost ranges from $1,400 to $3,500.
- Typical payback periods for a value engineered installation would be 3 to 7½ years.

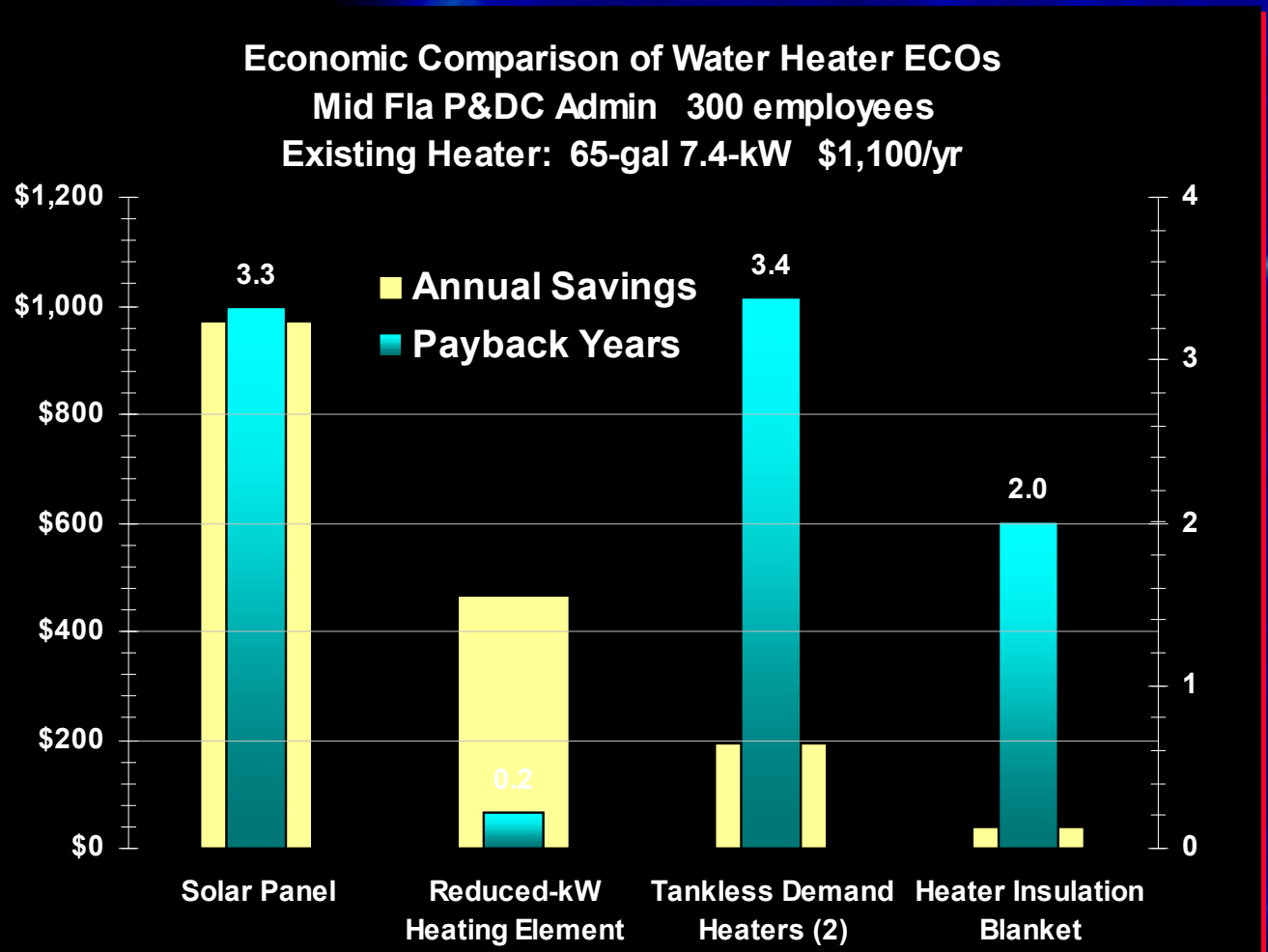
Example: A 4'x10' solar collector in San Juan will provide enough heat to offset 86% of the electric usage of a 40-gallon water heater. Annual savings including demand charges would be $390, this is a 90% savings. Installed cost would be about $1700, giving a 4½ -year payback period.

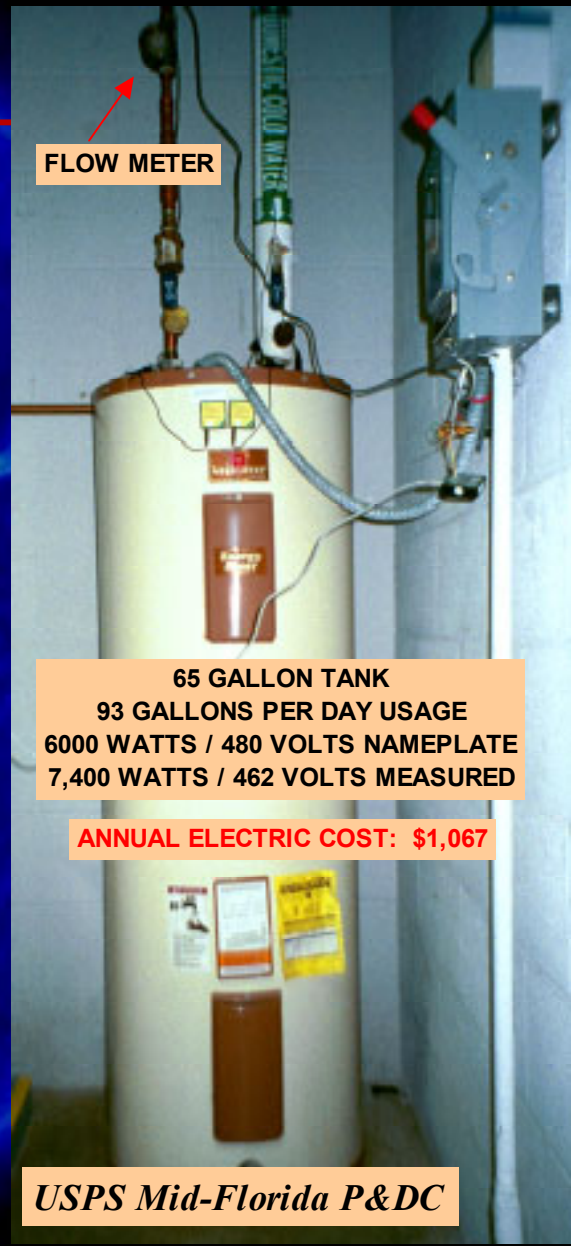
Breakdown of Heater Costs

Savings can be Significant Even When Hot Water Use is Low



Solar Case Study



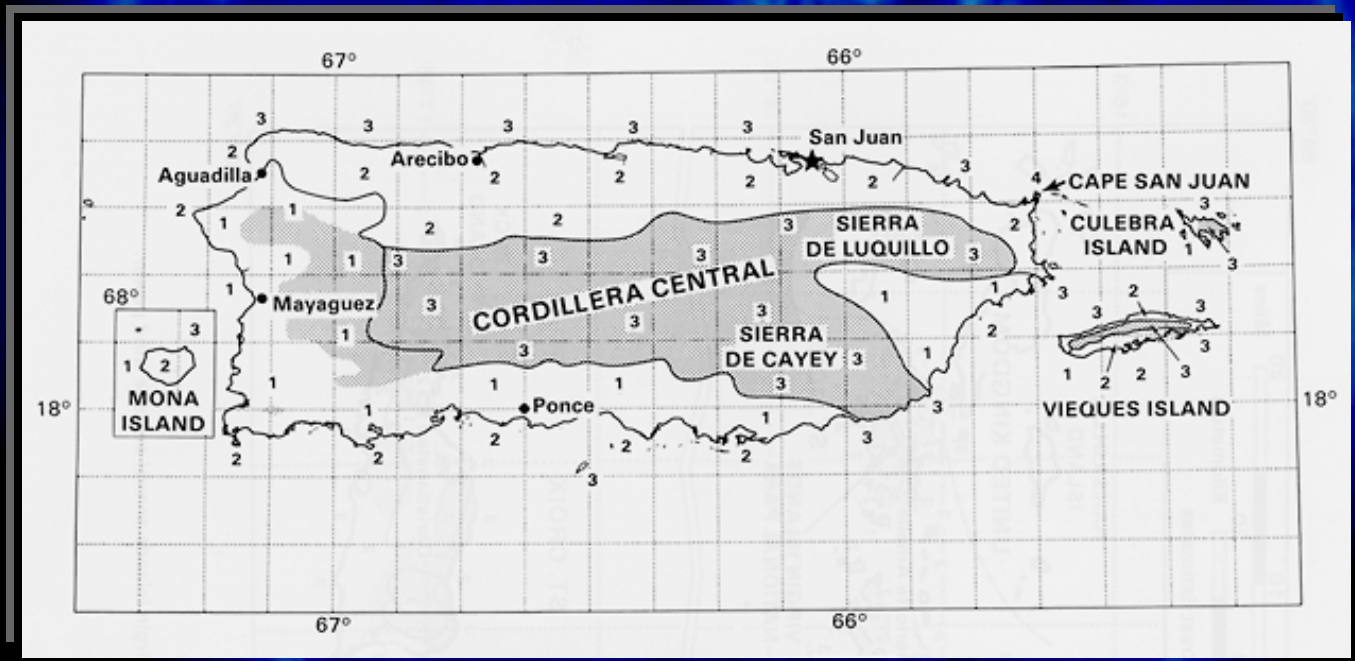


Wind Resource Potential

WIND CLASS	Resource Potential	Wind Speed at 50m high mph	Wind Speed at 50m high m/s
1	MINIMAL	9.8	4.4
2	MARGINAL	12.5	5.6
3	FAIR	14.3	6.4
4	GOOD	15.7	7.0
5	EXCELLENT	16.8	7.5

Wind Resource Map

CLASS 3 - Exposed points and capes along the entire northern coast, and most of the eastern coast
CLASS 4 - Cape San Juan and vicinity



Wind resource at a micro level can vary significantly. You should get a professional evaluation of your specific area of interest.

Windpower Jargon

- *Availability*—total number of hours the turbine produces power divided by the total hours in a year.
- *Capacity Factor*—amount produced as a percentage of the amount it would produce if operated at Rated Power during the entire year. Capacity factor for a wind farm ranges from 20% to 35%.
- *Cut-In Wind Speed*—the lowest wind speed to have a net energy output.
- *Rated Power*—kW a wind turbine is designed to generate at its Rated Wind Speed—for example, 100 kilowatts at 20 mph.
- *Wind Power Curve*—a graph that shows the relation of a turbine's net power to wind speed. Power increases proportionally with the cube of wind speed.

Wind Turbine Specifications

Category IV Hurricane:
Winds 131-155 mph
Category V Hurricane:
Winds greater than 155 mph

EXAMPLE: *Bergey XL.50*

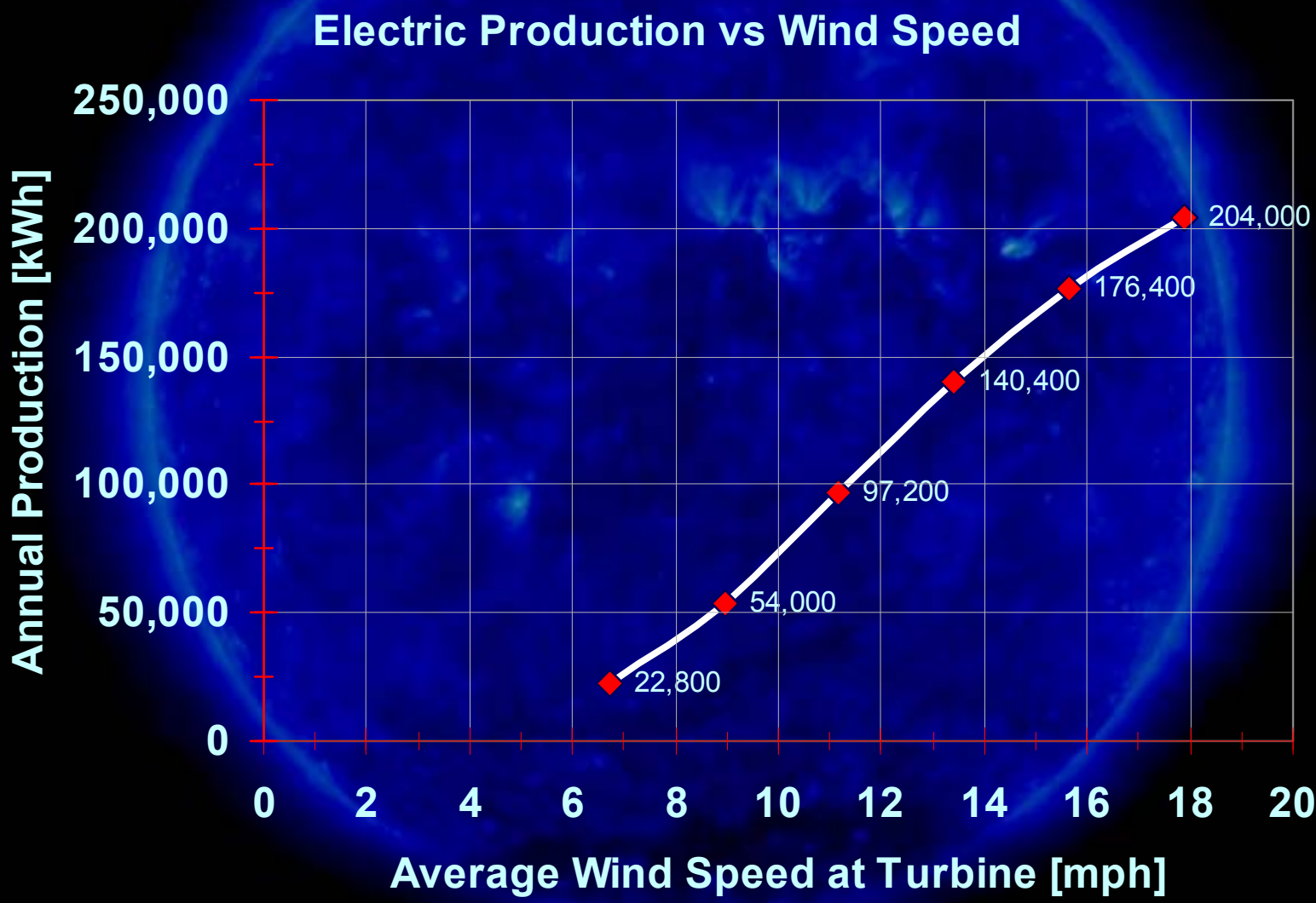
Type: 3 Blade Upwind
Rotor Diameter: 14 m (46 ft)

Start-up Wind Speed: 2.5 m/s (5.6 mph)
Cut-in Wind Speed: 2 m/s (4.5 mph)
Rated Wind Speed: 11 m/s (24.6 mph)
Design Wind Speed: 70 m/s (157 mph)

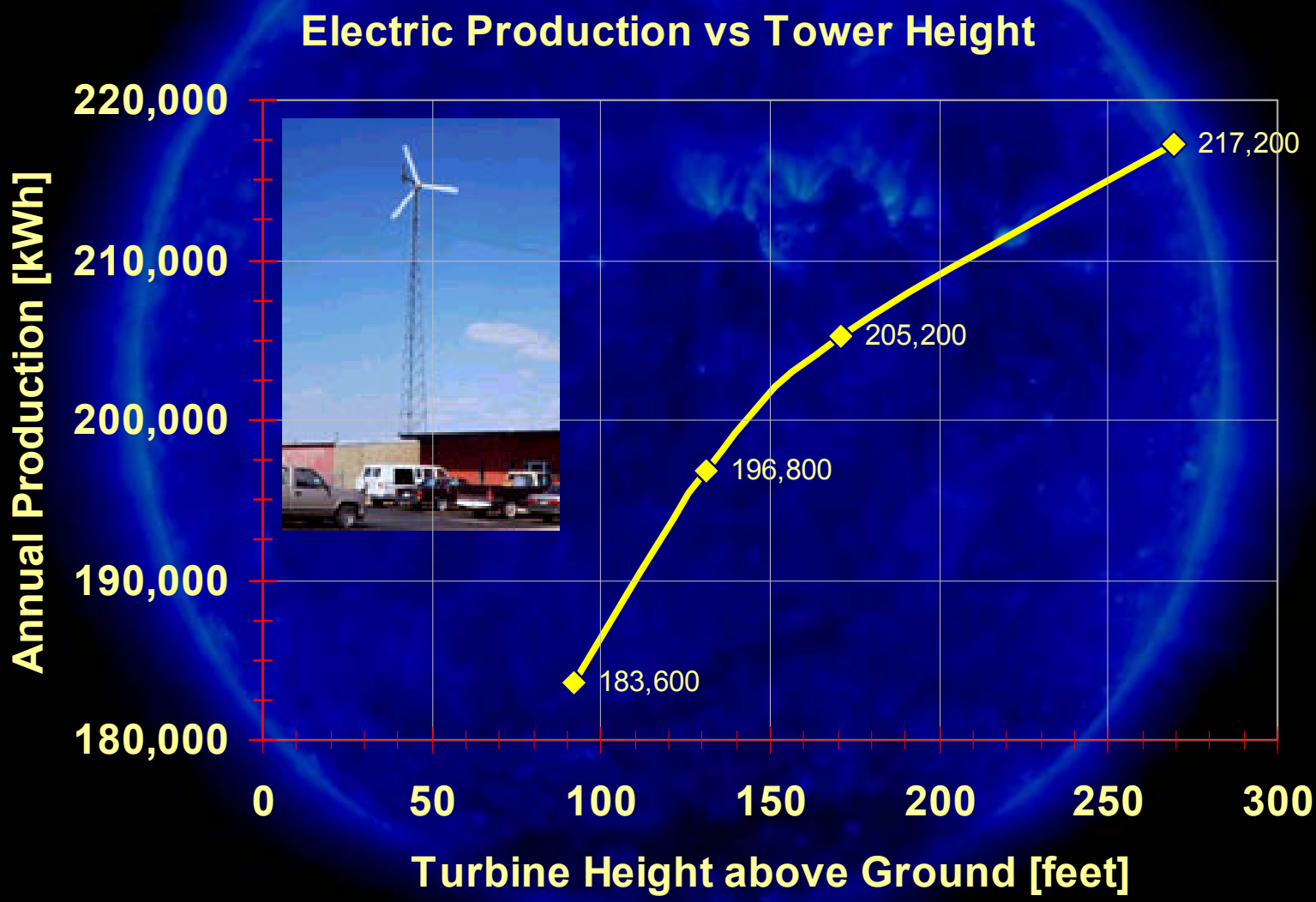
Max Stowed Wind Speed: 70 m/s (190 mph)

Rated Power: 50 kilowatts
Generator: Permanent Magnet Alternator
Output Form: 480 VAC, 3-phase, 60 Hz

Wind Power Curve



Wind Turbine Tower Height



Wind Power Economics

50 kW Turbine & Power Unit	$65,000
170 ft (52 m) tower	$15,000
Wind Study and Engineering	$20,000
Installation	$20,000
Total Cost:	**$120,000**

Average Wind Speed 13.4 mph (6 m/s) - Class 2 to 3

170 foot (52 meter) high tower

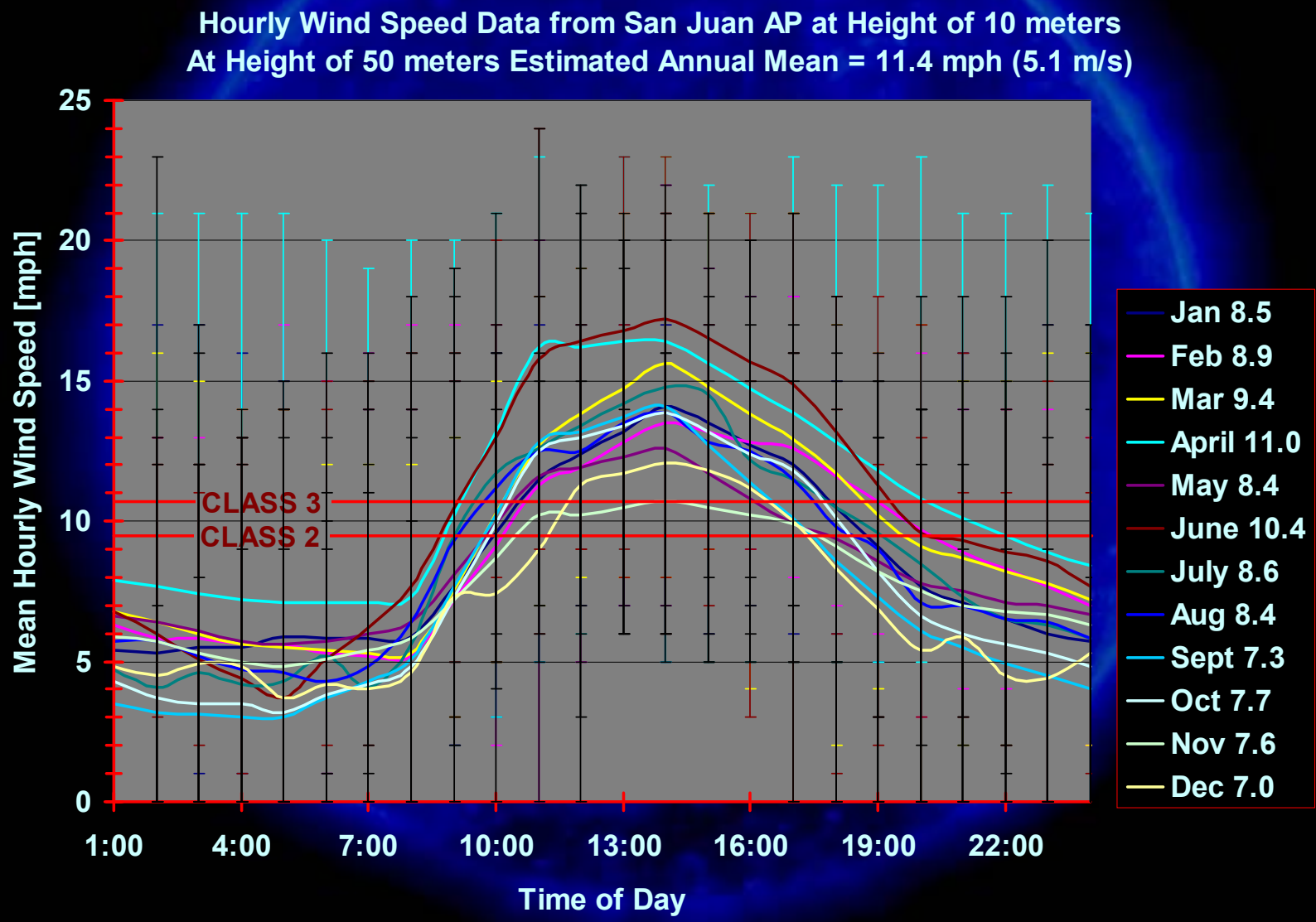
Annual Electric Production: 200,000 kWh

Electric rate of offset power: $0.097 per kWh + 5% taxes/fees

Annual Electric Bill Savings: $20,400

SIMPLE PAYBACK PERIOD: 5.9 years

Wind Data from San Juan AP



San Juan AP Site Economics

Average Wind Speed 11.4 mph (5 m/s) - Class 1 to 2

170 foot (52 meter) high tower

Annual Electric Production: 168,000 kWh

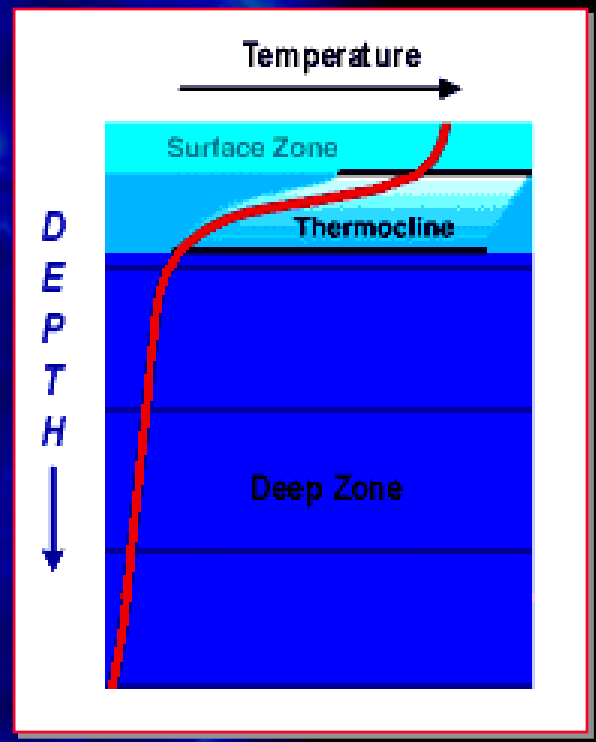
Electric rate of offset power: $0.097 per kWh + 5% taxes/fees

Annual Electric Bill Savings: $17,100

SIMPLE PAYBACK PERIOD: 7.0 years

Ocean Water Cooling

- Surface Temperature
  - 74 to 80 F (23 to 26 C)
- Thermocline Depth
  - *varies 25 to 300 feet*
- Thermocline Temperature
  - 62 to 74 F (17 to 23 C)
- Upper Deep Zone
  - 54 to 62 F (12 to 17 C)



Advanced Technologies

Internet Thermostats

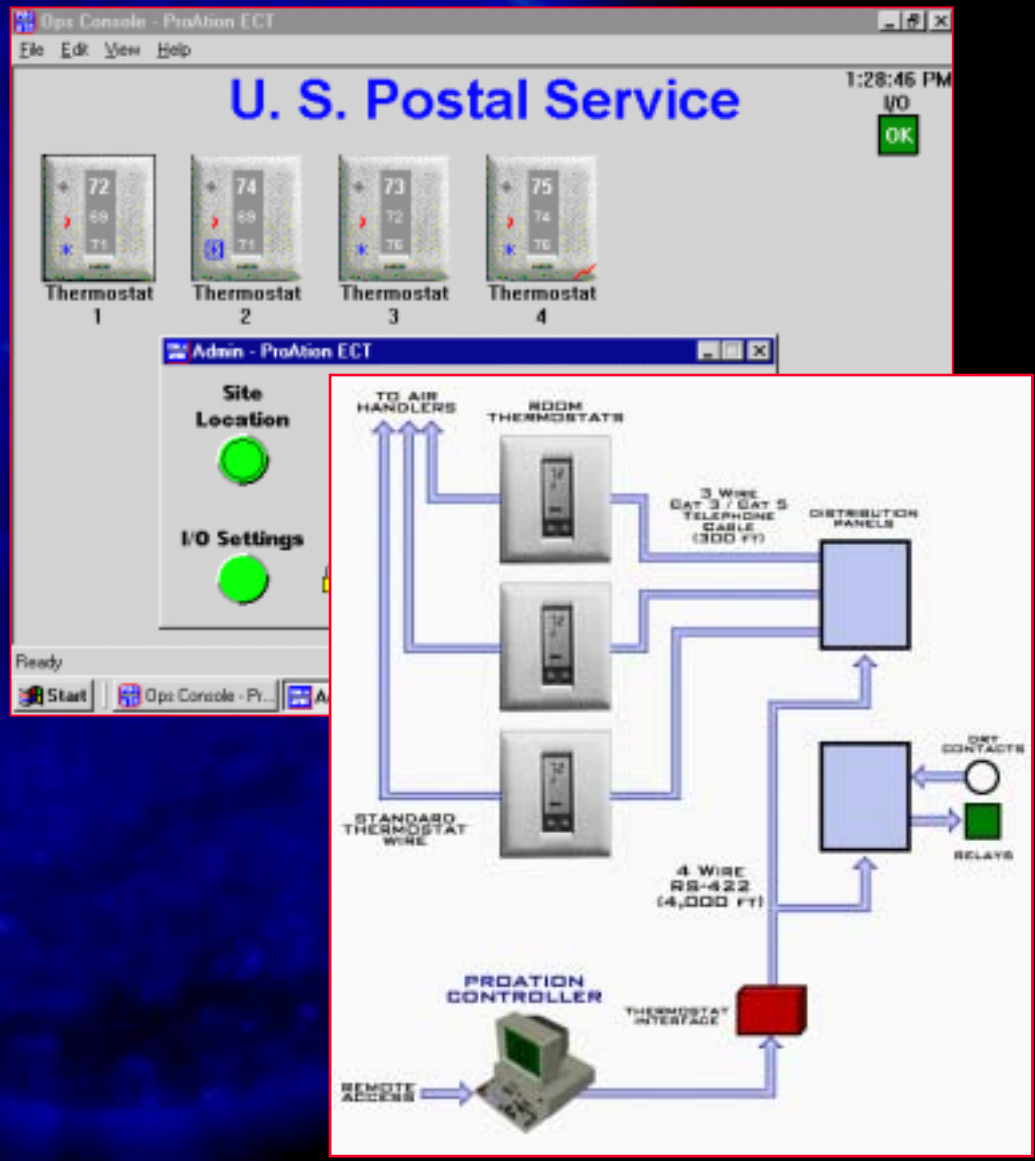
Internet Power Monitors

Integrated Building Automation

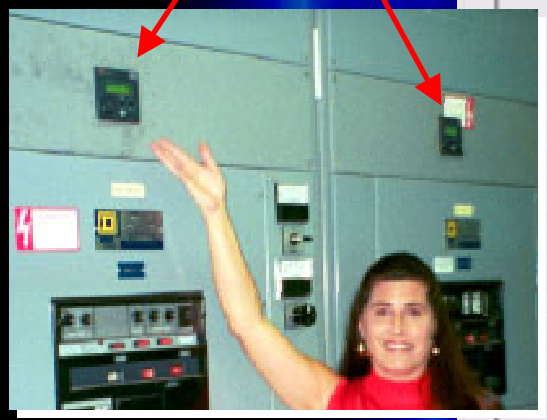
Demand-Controlled Ventilation

Internet Communicating Thermostats

- Monitor and Control All Thermostat Functions
- Access from any PC
- Observe, Trend, and Limit Set Point Changes
- Auxiliary Control and Monitoring of Lighting
- Cost Effective BAS for Groups of Smaller Buildings



Internet Power Monitors



PEGASYS VISTA - pwhite - [User Diagram:7300_FAC-4WYE_V2.1.0]

File Edit Options View Window Help

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Real-Time

Network Diagram

Real-Time

	VII	I	P
		820 A	201 kW
481 V			
480 V		862 A	215 kW
482 V			
		887 A	227 kW

V unbal [%] = 0.3

	A	B	C
Vln	278 V	278 V	277 V

VII avg	481 V
Vln avg	278 V
I avg	856 A
P tot	643 kW
Q tot	308 kVAR
S tot	713 kVA
Freq	60.00 Hz
PF sign	-90.2 %

Goes Up One Level

10:25 AM

Start LKMRF... PEGAS... VIP -NV... LOGSR... Ops Co... PEGAS... 10:25 AM

Office

Microsoft

Integrated Building Automation

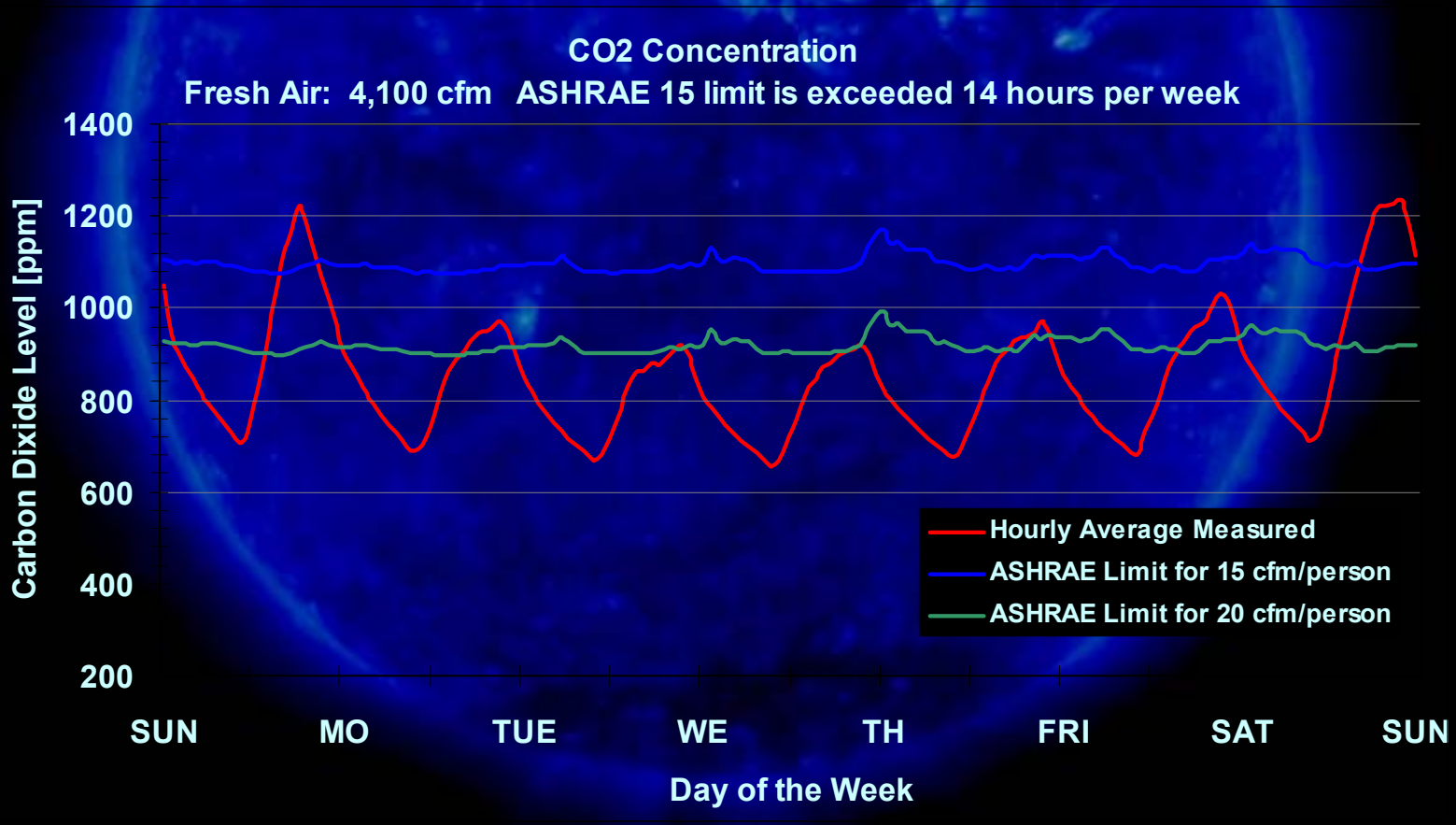
- Monitoring Energy Usage
  - Automated verification of utility bill's rate tiers
  - Ranking and comparison of buildings by type, usage, etc.
  - Easy identification of potential savings opportunities
- Demand Limiting and Load Shedding
  - Load curtailment spread over many buildings so that any changes go unnoticed by occupants
- Help Facilities Staff
  - Anticipate equipment failure from trends and historical data. Expedite troubleshooting decisions.

Demand-Controlled Ventilation

- Varies the flow of fresh outside air to meet occupant requirements
- Prevents over- and under-ventilating
- Occupant needs sensed by CO_2 level
  - Carbon Dioxide (CO_2) concentration varies with number of people, their activity level, and how long they are in the space
- Opens/Closes HVAC Fresh-air Damper and VAV dampers as needed

Demand-Controlled Ventilation

Example: US Air Force NCO Building
400 people nominal = 8,000 cfm fresh air
DCV allows reduction to 4,100 cfm minimum fresh air



If you would like an electronic copy of these presentation materials, please send me an email:

mwest@advantekinc.com

QUIZ Time!

QUIZ Time!

1. Most of Puerto Rico has Class-2 and Class-3 wind resources. How are *Wind Class* and wind data used?

QUIZ Time!

2. Solar water heating can pay for itself even if there is very little hot water use. When could this be true?

QUIZ Time!

3. The hardware needed to set up power monitoring and control from your desktop PC can pay for itself. Where do the savings come from?